

1           1.    A method comprising:  
2                forming a lower electrode;  
3                covering the lower electrode with a protective  
4 layer; and  
5                forming a phase change material over said lower  
6 electrode.

1           2.    The method of claim 1 further comprising:  
2                defining a singulated opening;  
3                forming a cup-shaped phase change material in  
4 said opening; and  
5                forming a thermally insulating material in the  
6 cup-shaped phase change material.

1           3.    The method of claim 2 including defining said  
2 phase change material using a planarization process.

1           4.    The method of claim 3 including defining said  
2 phase change material using a chemical mechanical  
3 planarization technique.

1           5.    The method of claim 2 including defining a  
2 sidewall spacer in said singulated opening.

1           6.    The method of claim 5 including defining an  
2 electrode in said opening.

1        7.    The method of claim 6 including using said  
2    sidewall spacer to define the cup-shape of said phase  
3    change material.

1        8.    The method of claim 6 including forming a base  
2    layer over a substrate and forming said lower electrode  
3    over said base layer.

1        9.    The method of claim 1 including sequentially  
2    forming said lower electrode and then said protective  
3    layer.

1        10.   The method of claim 9 including etching said  
2    lower electrode and said protective film using the same  
3    mask.

1        11.   A memory comprising:  
2            a lower electrode;  
3            a protective layer over said electrode; and  
4            a phase change material over said lower  
5    electrode.

1        12.   The memory of claim 11 further comprising:  
2            a support structure;

3 an insulator over said support structure, said  
4 insulator having an opening defined in said insulator;  
5 a cup-shaped phase change material in said  
6 opening; and  
7 a thermally insulating material in said cup-  
8 shaped phase change material.

1 13. The memory of claim 12 wherein said thermally  
2 insulating material fills said cup-shaped phase change  
3 material.

1 14. The memory of claim 11 wherein said phase change  
2 material is singulated.

1 15. The memory of claim 12 including a sidewall  
2 spacer in said singulated opening.

1 16. The memory of claim 15 wherein said electrode is  
2 located in said opening.

1 17. The memory of claim 16 wherein said cup-shaped  
2 phase change material is formed over said sidewall spacer.

1 18. The memory of claim 11 wherein said protective  
2 layer includes a material of the form  $\text{Si}_x\text{N}_y$ .

1 19. The memory of claim 18 wherein x is equal to  
2 three and y is equal to four.

1 20. The memory of claim 11 wherein said lower  
2 electrode is formed of carbon.

1 21. The memory of claim 11 including a base layer  
2 below said lower electrode.

1 22. The memory of claim 11 wherein said protective  
2 layer is an insulator.

1 23. The memory of claim 11 wherein said protective  
2 layer includes a central opening and said phase change  
3 material extends through said central opening to said lower  
4 electrode.

1 24. A memory comprising:  
2 a substrate;  
3 a lower electrode formed over said substrate;  
4 a phase change material covering a portion of  
5 said lower electrode; and  
6 a protective layer extending over a portion of  
7 said lower electrode not covered by said phase change  
8 material.

1        25. The memory of claim 24 wherein said protective  
2 layer includes a central opening and said phase change  
3 material contacts said lower electrode through said central  
4 opening.

1        26. The memory of claim 24 including a base layer  
2 between said substrate and said lower electrode.

1        27. The memory of claim 26 wherein said base layer is  
2 conductive.

1        28. The memory of claim 24 wherein said lower  
2 electrode includes carbon.

1        29. The memory of claim 24 wherein said protective  
2 film is an electrical insulator.

1        30. The memory of claim 29 wherein said protective  
2 layer includes a material in the form  $\text{Si}_x\text{N}_y$ .